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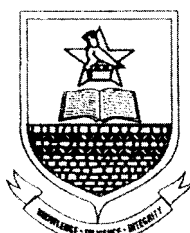
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University Of Zimbabwe

Evaluation of cost per test of clinical biochemistry tests at Parirenyatwa Central Hospital Laboratory, Harare, Zimbabwe

L MAKUWAZA, C MUSARURWA, ZAR GOMO

Abstract

Objectives: To determine the cost per test for selected clinical biochemistry tests at Parirenyatwa Central Hospital, Harare, Zimbabwe.

Design: A retrospective study for the month January 2003. Cost analysis was based on a 'bottom-up' micro cost analysis technique.

Setting: Parirenyatwa Central Hospital Laboratory

Results: There was wide variation between the cost of performing a test and the hospital fee schedule offered in payment. The greatest variation was obtained for low frequency tests and direct consumables accounted for 61.2% of the total costs.

Conclusion: Laboratory tests are heavily subsidized and there is need to contain the escalating costs by adopting some aggressive cost recovery measures. Introduction of systematic teaching of health economics in the colleges of health sciences is also advocated.

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Introduction

In many countries, including Zimbabwe, there is increasing concern at the high and increasing cost of providing quality healthcare to the community. Pathology services represent about 25% of this expenditure.¹ However, little is known about the actual cost to the Pathology Department of performing any individual pathology service or test. The health care market in Zimbabwe is characterised by a dominant public sector in both provision and financing of health services. Hongoro and Kumaranayake estimated that, in 1993, about 92% of health services in the country were provided by public institutions.²

In Zimbabwe, the rise in the cost of providing pathology services has been further exacerbated by perennial foreign currency constraints. This has resulted in regular increases in the cost of laboratory consumables since most of these are imported. As pressure on scarce resources mounts, there is need for a greater focus on the use of cost and cost effectiveness information to guide policy formulation.

Cost efficiency is the primary financial performance indicator for non-profit pathology laboratories and cost accounting is a key tool for managers of such institutions as they seek to keep costs under control. Pathology cost analysis provides a fiscal foundation that helps identify economical batch sizes; justify the adoption of new methods; determine optimum test frequency; analyse staff performance and instrument

efficiency.³ Cost effectiveness analysis thus, enables the adoption of the cheapest techniques to meet defined quantifiable targets.

Traditionally the Parirenyatwa Central Hospital (PCH) laboratory (Harare, Zimbabwe) a public institution, is allocated a 'top-down' annual budget into which the demands of the service are squeezed. Unfortunately, pathology laboratories remain demanded, with managers having little control over the increasing requirements of the clinical services for pathology services.⁴

There is a paucity of reports available in the literature on the secular trends in expense, productivity and utilisation of pathology services in Zimbabwe. Some relevant knowledge on cost information may be possessed by individual organisations but the accumulated data is often considered proprietary and is not presented in peer-reviewed publications. The objective of this study was to provide a 'snapshot in time' of the actual cost of performing selected clinical biochemistry tests at PCH laboratory. The obtained costs would then be compared with the prices on the Relative Value Schedule published by the National Association of Medical Aid Societies (NAMAS) and adopted by PCH to charge patients for pathology tests.

Materials and Methods

The costing study described in this report was carried out in the clinical biochemistry department at PCH.

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The study was carried out retrospectively for the month of January 2003. The department offers both emergency and routine diagnostic assays both of which are performed on a shared Beckman synchron CX5 analyser (Beckman Instruments Inc, Brea, USA).

The department's test menu is varied but the present study was limited to the following routine serum assays; urea and electrolytes (UEs) panel; liver function profile; plasma glucose; lipid profile; cardiac profile; bone profile; amylase; uric acid (UA) and pseudocholinesterase (PCHE). Heads of departments, relevant administration and accounting staff provided data on test counts, salaries and material, equipment and institutional overhead costs. The cost analysis was based on a 'bottom-up' microcost analysis technique developed by Travers and Krochmal.⁵ Individual tests constituting a panel were costed separately.

General Principles.

Prime costs: These are defined as those that are necessarily and exclusively incurred in measuring a specific analyte and consist of direct material and direct labour expenses.

Direct material expenses consist of expenditure for reagents and test associated consumables used to produce a test result. Built into these consumable costs per test, therefore, are the costs of calibration; controls; repeat analyses and priming.

Direct labour costs consisted of the total compensation required for personnel to perform all the pre-analytical, analytical and post analytical stages of a test procedure. Estimation of labour time per activity was calculated from timing studies as staff went about their duties. An average of two such studies was used to calculate the salary cost per test.

Indirect costs: These are costs that cannot be traced to a test (unit of output) or to a segment of the equipment or operational structure required to produce a test result. These include equipment related costs (incurred in purchasing, amortisation, installing and maintaining the equipment); indirect labour costs (total compensations for personnel involved in work that cannot be traced to any particular test e.g. messengers, accounting staff and supervisors); indirect consumable costs (analyser spares and common reagents) and institutional overhead costs (power, water, rent, phones and safety wear).

Indirect labour costs were shared with six other pathology departments using an allocation factor of 0.25 as was done for all shared moveable assets. An allocation factor of 0.1 was used to apportion institutional overheads to pathology services, 0.25 of which was allocated to clinical biochemistry. The clinical biochemistry totals for indirect costs were then shared equally among all tests done.

Capital depreciation in the health service has usually been defined by the opportunity for a replacement analyser. The amortisation period remains rather

haphazard and variable between pieces of equipment and between laboratories. In the present study, the life span of the analyser was put at 10 years.

Manufacturing costs: The cost of 'manufacturing' a test result was calculated as the sum of the prime and indirect costs.

Results

The calculated costs were converted to the US\$ using the prevailing official exchange rate at the time of the study which was Z\$824.00 to one US\$. The Z\$ was, however, trading for as much as Z\$1 500.00 to the US\$ on the parallel market. The figures are presented in both currencies.

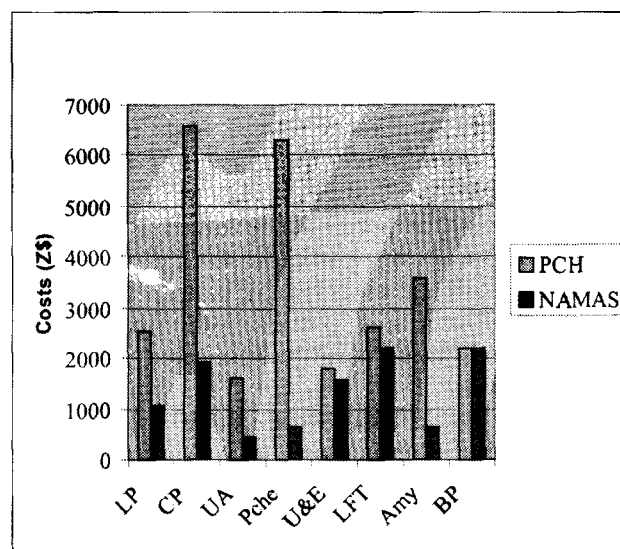
The most frequently requested tests included the UEs panel (n=1111), plasma glucose (n=468) and liver function profile (n=269) while the low frequency tests were lipid profile (n=26); UA (n=20); PCHE (n= 20); Amylase (n=7) and cardiac profile (n=7), (Table 1). These total counts excluded controls and calibrators.

Table I: Parirenyatwa Hospital clinical chemistry costs per test Z\$ (US\$).

Test	Number of requests	Total labour costs	Total direct costs	Total indirect costs	Total costs per test
Gluc	468	479.40	586.26	226.42	816.24(0.99)
Na	1217	180.08	215.13	226.42	441.55(0.54)
K	1179	180.08	215.01	226.42	441.43(0.54)
Urea	1111	180.08	251.66	226.42	478.08(0.58)
Creat	1051	180.08	208.57	226.42	434.99(0.53)
TP	304	132.52	163.69	226.42	390.11(0.47)
Alb	391	132.52	155.69	226.42	382.11(0.46)
T Bil	298	132.52	308.67	226.42	535.09(0.65)
C Bil	64	132.52	658.75	226.42	885.17(1.07)
ALP	269	132.52	210.53	226.42	436.95(0.53)
ALT	288	132.52	208.66	226.42	435.08(0.53)
AST	282	132.52	209.23	226.42	435.65(0.53)
Ca	114	180.08	339.40	226.42	565.82(0.69)
Mg	113	180.08	568.45	226.42	794.87(0.97)
Phos	113	180.08	231.88	226.42	458.30(0.56)
Amy	26	530.53	3362.38	226.42	3588.80(4.36)
Trig	26	305.54	1232.68	226.42	1459.10(1.77)
Chol	32	305.54	860.26	226.42	1086.68(1.32)
UA	20	530.53	1369.08	226.42	1595.50(1.94)
LD	20	305.54	793.97	226.42	1020.39(1.24)
CK	8	305.54	3056.99	226.42	3283.41(3.99)
HBD	7	305.54	2044.28	226.42	2270.70(2.76)
PCHE	20	530.531	6060.59	226.42	6287.01(7.63)
Total	7418	6914.59	23311.79	5207.66	28519.45(34.61)

Table I shows the cost per test/profile for PCH. Albumin had the lowest cost while PCHE had the highest cost. The low frequency tests had a higher calculated cost per test in comparison with the high frequency tests. PCHE, a low frequency test, had the highest cost per test while albumin (high frequency) had the lowest cost per test. Singular requests such as amylase, glucose and PCHE had high direct labour costs compared to panel tests in which the direct labour time was shared equally between tests constituting the panel.

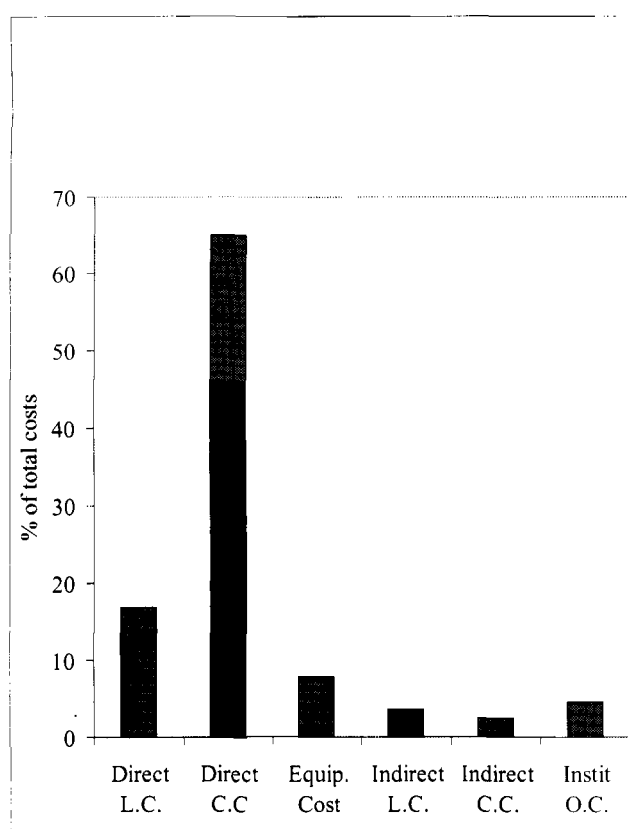
Figure I: Comparison of costs with prices charged.



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LP: Lipid profile.
CP: Cardiac profile.
UP: Uric acid.
PCHE: Pseudocholinesterase.
U&E: Urea and Electrolytes.
LFT: Liver function tests.
Amy: Amylase.
BP: Bone profile.

Figure I shows cost per test/profile and a comparison of the calculated cost per test/profile with the prices charged. There was very little correlation between the cost of performing a test and the government fee schedule offered in payment especially for the low frequency tests. The calculated cost per test range was Z\$382.11 to Z\$6 287.01 (US\$ 0.46 to \$7.63) compared to an actual price range of Z\$367.00 to Z\$637.00 (US\$0.45 to \$0.77). The greatest variation occurred for the rarely performed tests such as PCHE, cardiac profile, UA and amylase. During the period of the study the department made a net deficit of Z\$826 407.78 (US\$1 002.92). The greatest deficit occurred from glucose (Z\$208 578.24) (US\$253.13) and PCHE (Z\$113 000.20) (US\$137.14) whilst negligible gains were made from albumin (Z\$23 357.46) (US\$28.34) and from inorganic phosphate (Z\$9 119.10) (US\$11.07).

Figure II: Distribution of cost units as % of total.



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- Direct L.C:** Direct labour costs.
Direct C.C: Direct consumable costs.
Equip. cost: Equipment costs.
Indirect L.C: Indirect labour costs.
Indirect C.C: Indirect consumable costs.
Instit. O.C: Institutional overhead costs.

Figure II shows the distribution of cost units expressed as a percentage of total cost. Overall, the highest costs were attributable to direct consumables (61.21% of total costs) whilst the least costs were incurred for

indirect consumables (2.67%) making a total of 63.88% for consumable costs. Total labour costs constituted 22.27% with 18.36% going to direct labour. Reagents constituted the highest direct consumable costs. Amylase, creatine kinase, -hydroxybutyrate dehydrogenase, PCHE and UA had high reagent costs and consequently high direct consumable costs. The high frequency tests had relatively lower direct consumable costs when compared to low frequency tests.

Discussion

Reported pathology costing methods differ in detail but agree that total laboratory costs can be split into the direct and the indirect.^{4,7} We preferred the instrument cost accounting technique since the present study revolved on the one major analyser in use in the department.⁵

The practice of calculating individual test costs has been discouraged primarily on the basis of the need for frequent recalculations as input costs change. Reluctance to embark on costing studies stems from the mistaken belief that the amount of effort necessary for reliable costing is incommensurate with possible benefits. However, in present day hyperinflationary Zimbabwe, quotations for consumables are valid for short durations and regular salary reviews are the order of the day. Frequent recalculation of actual cost data, is therefore, desirable.

Total labour costs constituted a mere 22.27% of total costs, a proportion at variance with reports from other researchers who attribute over 50% of total costs to labour.^{7,8} This finding indicates that laboratory staff salaries are not keeping pace with inflation. Labour costs may, however, be reduced further by rationalising staff allocation per workstation, but such a move poses the risk of compromising work quality.

Direct consumable costs tended to increase with increasing reagent price. Both direct labour and direct consumable costs per test were lower for the panel tests than for singular requests. The higher costs for singular requests, could be reduced by avoiding multiple bleeding of the same patient and, where possible, including all relevant tests on one request. Further savings could be achieved by use of in-house consumables such as reagents, control and calibration material. Another option would be to purchase long-shelf-life reagents in bulk and to identify alternative cheaper methods. Staff should also be made aware of the actual costs of the various consumables if they are to contribute towards cost containment.

Low frequency tests were associated with a higher number of non-chargeable tests (controls and calibrators) thus contributing to their high cost. Deleting from the repertoire uninformative tests and subcontracting the useful high cost low frequency tests to other laboratories could achieve effective savings. Batching of low frequency tests could also be adopted but that option could result in costly clinical delays in

patient management.

The price schedule, although revised regularly, is largely a historical document in which the set fees bear little resemblance to the true cost of performing pathology services. Health service providers should regularly carry out comprehensive cost analysis studies, which would help strengthen their demands for fees adjustment. Our data demonstrates that laboratory tests are heavily subsidised. Each institution has its own unique test cost profile based on salary scales and workflow efficiency and practitioners should be encouraged to regularly calculate their cost data and institute appropriate cost containment measures as required.

Without good financial and activity information, laboratories risk falling prey to institutional 'gut feelings' of their being over-resourced, wasteful and self-indulgent. With good data at hand, pathology departments can demonstrate efficient management and patient care, and help plan and remain part of the future in their hospitals. This may start by adopting aggressive cost recovery measures and the introduction of systematic teaching of health economics in the colleges of health sciences.

Acknowledgements

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